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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/669,135	09/23/2003	Milan Kokta	1035-BI4307	2824
34456	7590	05/25/2005	EXAMINER	
TOLER & LARSON & ABEL L.L.P. 5000 PLAZA ON THE LAKE STE 265 AUSTIN, TX 78746			SONG, MATTHEW J	
			ART UNIT	PAPER NUMBER
			1722	
DATE MAILED: 05/25/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/669,135

Applicant(s)

KOKTA ET AL.

Examiner

Matthew J. Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 07 April 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) 10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 and 11-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/7/05; 1/28/05;
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

***Election/Restrictions***

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-9 and 11-31, drawn to a process, classified in class 117, subclass 11.
- II. Claim 10, drawn to a product, classified in class 428, subclass 64.1.

2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product as claimed can be made by another and materially different process, such as flame fusion, which does not utilize a crucible.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Jeffery Abel on 4/18/2005 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-9 and 11-31. Affirmation of this election must be made by applicant in replying to this Office action. Claim 10 is withdrawn

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from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

***Information Disclosure Statement***

5. The information disclosure statement filed 9/23/2003 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because Auzel et al (AL), Kleber et al (AY) and Seifert (AZ) are not in the English Language. No English abstracts are present in the application for said references. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 ¶ C(1).

6. The information disclosure statement filed 1/28/2005 fails to comply with the provisions of 37 CFR 1.97, 1.98 and MPEP § 609 because Tempel et al (BH) and Tempel et al (BI) are not in the English Language. No English Abstracts are present in the application for said references. It has been placed in the application file, but the information referred to therein has not been considered as to the merits. Applicant is advised that the date of any re-submission of any item of information contained in this information disclosure statement or the submission of any missing element(s) will be the date of submission for purposes of determining compliance with

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the requirements based on the time of filing the statement, including all certification requirements for statements under 37 CFR 1.97(e). See MPEP § 609 ¶ C(1).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grabmaier et al ("Czochralski Growth of Magnesium-Aluminum Spinel") in view of Robinson et al (US 3,808,065).

In a method of growing spinel single crystals, note entire reference, Grabmaier et al discloses growing stoichiometric Mg-Al spinel and a crystal with a molar ratio of Mg):Al<sub>2</sub>O<sub>3</sub>=1:3.2. Grabmaier et al also discloses using a Czochralski method to grow the crystal,

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this reads on applicant's boule, using a seed crystal, a melt contained in an iridium crucible and a pulling rate of 0.5 cm/hr. Grabmaier et al also discloses the crystal could be sawed unannealed without cracking (pg 355-356), this reads on applicant's annealing time period not greater than 50 hours because the annealing time is 0.

Grabmaier et al discloses sawing the boule into a plurality of wafers.

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Grabmaier et al by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

9. Claims 1-4, 6-20, 22-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schmid (US 3,898,051) in view of Robinson et al (US 3,808,065).

In a method of growing single crystals, note entire reference, Schmid discloses a single crystal is grown by melting a material in a crucible and solidifying the melted material (Abstract). Schmid also discloses growing spinel crystals (col 1, ln 1-15). Schmid also discloses growing stoichiometric  $\text{MgAl}_2\text{O}_4$  spinel single crystals (col 9, ln 5-20). Schmid also discloses after solidification a single crystal boule 104 is cooled to room temperature at a rate of about 50°C per hour after annealing for a few hours (col 5, ln 55-68 and col 6, ln 50 to col 7, ln 15).

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Schmid also discloses the crystal is grown to be approximately equal to the diameter of crucible (Fig 3d).

Schmid does not disclose slicing the boule into a plurality of wafers

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Schmid by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

Referring to claims 1-4, the combination of Schmid and Robinson et al teaches a batch melt in a crucible; growing a spinel boule from the melt ('051 col 9, ln 1-20 and col 5, ln 60-68); annealing for a few hours ('051 col 7, ln 1-15), this reads on applicant's annealing is restricted to a time period not greater than about 10 hours because few is a term used to represent a small number; and slicing the boule into wafers ('065 col 1, ln 1-35).

Referring to claims 6-8, 17-19, and 27-29, the combination of Schmid and Robinson et al teaches forming stoichiometric  $\text{MgAlO}_4$ . The combination of Schmid and Robinson et al does not teach forming a non-stoichiometric spinel. Changes in concentration are held to *prima facie* obvious (MPEP 2144.05) and non-stoichiometric spinel crystals are known in the art, as evidenced by Grabmaier et al above.

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Referring to claims 9, 22 and 30, the combination of Schmid and Robinson et al teaches forming a single crystal by cooling a melt using a temperature gradient ('051 col 5, ln 25-55), this reads on applicant's Bridgman method.

Referring to claim 10-15, the combination of Schmid and Robinson et al teaches forming a crystal with a diameter approximately equal to the diameter of the crucible, which is approximately an aspect ratio of 1.

Referring to claim 16, the combination of Schmid and Robinson et al does not teach the process aspect ratio is effective to prevent flipping of the boule from a [111] orientation to a different orientation. The combination of Schmid and Robinson et al teaches a process aspect ratio within the claimed range; therefore the ratio taught by the combination of Schmid and Robinson et al inherently prevent flipping because the ratio is within the range of ratios taught by applicant's to prevent flipping.

Referring to claim 24-26, the combination of Schmid and Robinson et al teaches cooling to room temperature at a rate of approximately 50°C/hr ('051). The combination of Schmid and Robinson et al does not teach cooling at a rate not less than 100°C/hr, 200°C/hr or 300°C/hr. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Schmid and Robinson et al by cooling at the claimed rate to increase productivity by reducing the time required to cool the boule.

Referring to claim 31, the combination of Schmid and Robinson et al teaches a batch melt in a crucible; growing a spinel boule from the melt which has a diameter approximately equal to the diameter of the crucible ('051 col 9, ln 1-20 and col 5, ln 60-68 and Fig 3d); annealing for a few hours ('051 col 7, ln 1-15), this reads on applicant's annealing is restricted to a time period



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not greater than about 10 hours because few is a term used to represent a small number; and slicing the boule into wafers ('065 col 1, ln 1-35).

10. Claims 23-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Giess et al ("Growth of Single Crystal  $\text{MgGa}_2\text{O}_4$  Spinel") in view of Robinson et al (US 3,808,065).

In a method of growing spinel crystals, note entire reference, Giess et al discloses a method of growing large single crystal boules of a  $\text{MgGa}_2\text{O}_4$  Spinel using the Czochralski pulling method and a melt within an iridium crucible, this reads on applicant's batch melt in a crucible. Giess et al also discloses the crystal is slowly cooled from the growth temperature of  $1950 \pm 100^\circ\text{C}$  to room temperature over a period of 16 hours (pg 151-152 and Figure). The rate can be determined to be approximately  $128^\circ\text{C/hr}$ .

Giess et al does not disclose slicing the boule into a plurality of wafers.

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Giess et al by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

Referring to claims 23-24, the combination of Giess et al and Robinson et al teaches a rate of approximately  $128^\circ\text{C/hr}$  is within the claimed cooling rate range.

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Referring to claim 25-26, the combination of Giess et al and Robinson et al does not teach cooling at a rate not less than 200°C/hr or 300°C/hr. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Giess et al and Robinson et al by cooling at the claimed rate to increase productivity by reducing the time required to cool the boule.

Referring to claim 27, the combination of Giess et al and Robinson et al teaches slight excess of  $\text{Ga}_2\text{O}_3$ , this reads on applicant's non-stoichiometric.

Referring to claim 28-29, the combination of Giess et al and Robinson et al teaches a method of forming  $\text{MgGa}_2\text{O}_4$  and  $\text{MgAl}_2\text{O}_4$  is a single crystal spinel is important in the semiconductor industry. The combination of Giess et al and Robinson et al does not teach form  $\text{MgAl}_2\text{O}_4$ . It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Giess et al and Robinson et al by forming a single crystal of  $\text{MgAl}_2\text{O}_4$  because it is useful in the semiconductor industry.

Referring to claim 30, the combination of Giess et al and Robinson et al teaches a Czochralski method.

11. Claims 10-20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wyon et al ("Czochralski growth and optical properties of magnesium-aluminum spinel doped with nickel") in view of Robinson et al (US 3,808,065).

In a method of growing spinel single crystals, note entire reference, Wyon et al discloses  $\text{MgAl}_2\text{O}_4$  crystal doped with nickel ( $\text{Mg}_{1-x}\text{Ni}_x\text{Al}_2\text{O}_4$ ) are pulled from a melt contained in a crucible. Wyon et al also discloses a crucible diameter of 60 mm and crystals with a diameter of

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25 mm (pg 710-711). The process aspect ratio can be determined to be 0.4166. Wyon et al also discloses the preferential growth axis is  $\langle 111 \rangle$  (pg 711). Wyon et al discloses boules (pg 712).

Wyon et al does not disclose slicing the boule into a plurality of wafers.

In a method of manufacturing spinel wafers, note entire reference, Robinson et al teaches single crystal spinel boules are sliced into wafers with a diamond saw. Robinson et al also teaches spinel wafers with smooth surfaces are useful as substrates in the electric integrated circuit art (col 1, ln 1-35).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Wyon et al by slicing the single crystal spinel boule into wafers, as taught by Robinson et al, to form substrates useful in the electronic integrated circuit art.

Referring to claim 13, the combination of Wyon et al and Robinson et al teach a ratio of 0.416, this reads on applicant's about 0.42 because using conventional rounding techniques to round 0.416 to two significant digits results in 0.42.

Referring to claim 14-15, the combination of Wyon et al and Robinson et al teach a ratio of 0.416. The combination of Wyon et al and Robinson et al does not teach a ratio not less than about 0.43 or 0.44. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Wyon et al and Robinson et al to have a process aspect ratio within the claimed range by increasing the size of the boule because larger boules are desirable in the art. Furthermore, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties (MPEP 2144.05).

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Referring to claim 16, the combination of Wyon et al and Robinson et al does not teach the process aspect ratio is effective to prevent flipping of the boule from a [111] orientation to a different orientation. The combination of Wyon et al and Robinson et al teaches a process aspect ratio within the claimed range; therefore the ratio taught by the combination of Wyon et al and Robinson et al inherently prevent flipping because the ratio is within the range of ratios taught by applicant's to prevent flipping.

Referring to claim 17-19, the combination of Wyon et al and Robinson et al teaches a  $\text{Mg}_{1-x}\text{Ni}_x\text{Al}_2\text{O}_4$  crystal, this reads on applicant's stoichiometric crystal.

Referring to claim 20, the combination of Wyon et al and Robinson et al teaches crystals pulled by seeding from an iridium wire, this reads on applicant's seed crystal.

Referring to claim 22, the combination of Wyon et al and Robinson et al teaches a Czochralski technique.

12. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wyon et al ("Czochralski growth and optical properties of magnesium-aluminum spinel doped with nickel") in view of Robinson et al (US 3,808,065) as applied to claims 10-20 and 22 above, and further in view of Li (US 5,968,267).

The combination of Wyon et al and Robinson et al teach all of the limitations of claim 21, as discussed previously, except rotating the seed crystal.

In a Czochralski method of crystal growth, note entire reference, Li teaches its is common practice is a Czochralski process to rotate the seed about its longitudinal axis during the pulling process in order to grow a crystal with a more uniform cross section and the crucible

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holding the melt may also be rotated to grow a crystal with a more uniform cross section (col 2, ln 35-65).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Wyon et al and Robinson et al by rotating the seed crystal, as taught by Li, to grow a crystal with a more uniform cross section.

### *Conclusion*

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Grabmaier (US 3,625,868) teaches forming a spinel monocrystal using a Czochralski process, note entire reference.

Maguire et al (US 4,347,210) teaches forming spinel single crystals using a Czochralski process or a flame fusion process.

Cullen et al (US 3,883,313) teaches forming a spinel single crystal with a non-stoichiometric composition (Abstract).

Wang et al (US 4,370,739) teaches forming a spinel single crystal boule by the Czochralski method and cutting the crystal to obtain wafers (col 4-5).

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 571-272-1137. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song  
Examiner  
Art Unit 1722

MJS  
April 29, 2005



**ROBERT KUNEMUND  
PRIMARY EXAMINER**